Chapter I4: Economic Value of I&E Losses Based on Benefits Transfer Techniques

This chapter presents the results of EPA's evaluation of the economic losses associated with I&E at the Detroit Edison Monroe Power Plant using benefits transfer techniques. Section I4-1 provides an overview of the valuation approach, Section I4-2 discusses the value of recreational fishery losses, Section I4-3 discusses commercial fishery values, Section I4-4 discusses the value of forage species losses, Section I4-5 discusses nonuse values, and Section I4-6 summarizes the benefits transfer results.

CHAPTER CONTENTS

I4-1 Overview of Valuation Approach

Fish losses from I&E at Monroe affect recreational and commercial fisheries as well as forage species that contribute to the biomass of recreational and commercial species. EPA evaluated all of these species groups to capture the total economic impact of I&E at Monroe.

Recreational fishery impacts are based on benefits transfer methods, applying the results from nonmarket valuation studies. Commercial fishery impacts are based on commodity prices for the individual species. The economic value of forage species losses is determined by estimating the replacement cost of these fish if they were to be restocked with hatchery fish, and by considering the foregone biomass production of forage fish resulting from I&E losses and the consequential foregone production of commercial and recreational species that use the forage species as a prey base. All of these methods are explained in further detail in the Chapter A9 of Part A of this document.

Many of the fish species impacted by I&E at Monroe are harvested both recreationally and commercially. To avoid double-counting the economic impacts of I&E on these species, EPA determined the proportion of total species landings attributable to recreational and commercial fishing, and applied this proportion to the impacted fishery catch. For example, if 30 percent of the landed numbers of one species are harvested commercially at a site, then 30 percent of the estimated catch of I&E-impacted fish are assigned to the increase in commercial landings. The remaining 70 percent of the estimated total landed number of I&E-impacted adult equivalents are assigned to the recreational landings.

The National Marine Fisheries Service (NMFS) provides both recreational and commercial fishery landings data by state. To determine what proportions of total landings per state occur in the recreational or commercial fishery, EPA summed the landings data for the recreational and commercial fishery, and then divided by each category to get the corresponding percentage. The percentages applied in this analysis are presented in Table I4-1.

As discussed in Chapters A5 and A9 of Part A of this document, the yield estimates presented in Chapter I3 are expressed as total pounds for both the commercial and recreational catch combined. For the economic valuation discussed in this chapter, total yield was partitioned between commercial and recreational fisheries based on the landings in each fishery (presented in Table I4-1). Because the economic evaluation of recreational yield is based on numbers of fish rather than pounds, foregone recreational yield was converted to numbers of fish, based on the average weight of harvestable fish of each species. Table

I4-2 shows these conversions for impingement and Table I4-3 displays these data for entrainment using the data presented in Section I3-4 of Chapter I3. Note that the numbers of foregone recreational fish harvested are typically lower than the numbers of age 1 equivalent losses, since the age of harvest of most fish is greater than age 1.

Table I4-1: Percentages of Total I&E Impacts at Monroe Occurring to Recreational and Commercial Fisheries[a]

Fish Species	Percent Impacts to Recreational Fishery	Percent Impacts to Commercial Fishery
Bluegill	100	0
Bullhead spp.	0	100
Burbot	50	50
Carp	0	100
Channel catfish	50	50
Crappie	100	0
Freshwater drum	0	100
Gizzard shad	0	100
Muskellunge	100	0
Smallmouth bass	100	0
Smelt	50	50
Suckers	0	100
Sunfish	100	0
Walleye	100	0
White bass	50	50
Whitefish	50	50
Yellow perch	100	0

[a] Accurate recreational landings data for Lake Erie have not yet been located, and thus EPA applied a 50/50 split for species that are both commercially and recreationally harvested.
Fri Feb 15 13:45:13 MST 2002 ; TableA:Percentages of total impacts occurring to the commercial and recreational fisheries of selected species; Plant: monroe ; Pathname: P:/Intake/Great_Lakes/GL_Science/scodes/monroe/tables.output/TableA.Perc.of total.impacts.monroe.csv

Table I4-2: Summary of Mean Annual Impingement of Fishery Species at Monroe

Species	Impingement Count (#)	Age 1 Equivalents (#)	Total Catch (#)	Total Yield (lb)	Commercial Catch (#)	Commercial Yield (lb)	Recreational Catch (#)	Recreational Yield (lb)
Bluegill	375	447	1	0	0	0	1	0
Bullhead spp.	866	1,007	50	22	50	22	0	0
Carp	3,550	3,891	288	1,880	288	1,880	0	0
Channel catfish	666	859	32	27	16	13	16	13
Crappie	655	793	12	7	0	0	12	7
Freshwater drum	128,424	148,171	8,614	7,871	8,614	7,871	0	0
Gizzard shad	19,655,012	34,323,242	4,375,502	1,354,816	4,375,502	1,354,816	0	0
Muskellunge	4	4	0	0	0	0	0	0
Smallmouth bass	97	141	10	6	0	0	10	6
Smelt	4,260	5,132	117	44	58	22	58	22
Suckers	4,139	4,958	122	62	122	62	0	0
Sunfish	3,706	6,177	36	2	0	0	36	2
Walleye	16,687	22,658	178	334	0	0	178	334
White bass	548,775	662,353	54,381	50,469	27,190	25,235	27,190	25,235
Yellow perch	224,123	264,144	2,237	282	0	0	2,237	282
Commercial and Recreational Species Total	20,591,339	35,443,976	4,441,580	1,415,820	4,411,841	1,389,920	29,739	25,900

Table I4-3: Summary of Mean Annual Entrainment Results of Fishery Species at Monroe

Species	Entrainment Count (#)	Age 1 Equivalents (#)	Total Catch (#)	Total Yield (lb)	Commercial Catch (#)	Commercial Yield (lb)	Recreational Catch (#)	Recreational Yield (lb)
Burbot	2,770,000	1,765	132	206	66	103	66	52
Carp	79,700,000	394,554	29,161	190,659	29,161	190,659	0	0
Channel catfish	4,160,000	20,594	775	643	387	322	387	161
Crappie	580,000	23,517	347	195	0	0	347	98
Freshwater drum	158,000,000	143,558	8,346	7,626	8,346	7,626	0	0
Gizzard shad	4,080,000,000	8,747,005	1,115,062	345,264	1,115,062	345,264	0	0
Smallmouth bass	599,000	48,283	3,399	1,972	0	0	3,399	986
Smelt	11,000,000	89,543	2,038	766	1,019	383	1,019	192
Suckers	6,204,000	89,117	2,198	1,108	2,198	1,108	0	0
Sunfish	923,000	311,090	1,821	113	0	0	1,821	57
Walleye	2,080,000	16,749	132	247	0	0	132	124
White bass	156,000,000	772,277	63,406	58,845	31,703	29,423	31,703	14,712
Whitefish	190,000	81	50	73	25	36	25	18
Yellow perch	128,000,000	567,330	4,805	605	0	0	4,805	303
Commercial and Recreational Species Total	4,630,206,000	11,225,463	1,231,670	608,321	1,187,966	574,923	43,704	16,704

I4-2 Value of Baseline Recreational Fishery Losses at the Monroe Facility

I4-2.1 Economic Values for Recreational Losses Based on Literature

There is a large literature that provides willingness-to-pay values for increases in recreational catch rates. These increases in value are benefits to the anglers, and are often referred to by economists as a "consumer surplus" per additional fish caught.

When using values from the existing literature as proxies for the value of a trip or fish at a site not studied, it is important to select values for similar areas and species. Table I4-4 gives a summary of several studies that are closest to the Great Lakes fishery in geographic area and relevant species.

McConnell and Strand (1994) estimated fishery values using data from the National Marine Fisheries Statistical Survey. They created a random utility model of fishing behavior for nine Atlantic states, the northernmost being New York. In this model they specified four categories of fish: small gamefish (e.g., striped bass), flatfish (e.g., flounder), bottomfish (e.g., weakfish, spot, Atlantic croaker, perch), and big gamefish (e.g., shark). For each fish category, they estimated per angler values for access to marine waters and for an increase in catch rates.

Boyle et al. (1998) used the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation to estimate the marginal economic value of an additional bass, trout, and walleye per trip.

Sorg et al. (1985) used travel cost and contingent valuation methods to estimated the value of recreational fishing at 51 sites in Idaho. Several of the species valued in Sorg et al. are also found in the Great Lakes fishery.

Milliman et al. (1992) used a logit model, creel data, and the responses to a contingent valuation dichotomous choice survey question the study estimated the value of recreational fishing for yellow perch in Green Bay, Michigan.

Table I4-4: Selected Valuation Studies for Estimating Changes in Catch Rates

Authors	Study Location and Year	Item Valued	Value Estimate ($2000)	
McConnell and Strand (1994)	Mid- and south Atlantic coast, anglers targeting specific species, 1988	Catch rate increase of 1 fish per trip[a]	Small gamefish	$10.06
Hicks et al. (1999)	Mid-Atlantic coast, 1994	Catch rate increase of 1 fish per trip	Small gamefish Bottomfish	$2.95 $2.38
Boyle et al. (1998)	National, by state, 1996	Catch rate increase of 1 fish per trip	Bass (low/high)	$1.58 - $5.32
Sorg et al. (1985)	Idaho, 1982	Catch rate increase of 1 fish per trip	Warmwater fish	$5.02
Milliman et al. (1992)	Green Bay	Catch rate increase of 1 fish per trip	Yellow perch	$0.31
Charbonneau and Hay (1978)	National, 1975	Catch rate increase of 1 fish per trip	Walleye Catfish Panfish	$7.92 $2.64 $1.00

[a] Value was reported as "two month value per angler for a half fish catch increase per trip." From 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (U.S. DOI, 1997), the average saltwater angler takes 1.5 trips in a 2 month period. Therefore, to convert to a "1 fish per trip" value, EPA divided the 2 month value by 1.5 trips and then multiplied it by 2, assuming the value of a fish was linear.

Charbonneau and Hay (1978) used travel cost and contingent valuation methods to estimate the consumer surplus for a season of the respondent's favorite wildlife-related activity. These consumer surplus values were then converted to a one fish increase per trip.

I4-2.2 Baseline Losses in Recreational Yield at Monroe and Value of Losses

Since most of these studies discussed in the previous section do not consider the Great Lakes fishery directly, EPA used these estimates to create a range of possible consumer surplus values for the recreational fish landings gained by reducing impingement and entrainment at the Monroe facility. To estimate a unit value for recreational landings, EPA established a lower and upper value for the recreational species, based on values reported in studies in Table I4-4. EPA estimated the economic value of I&E impacts to recreational fisheries using the I&E estimates presented in Tables I4-2 and I4-3 and the economic values in Table I4-5.

EPA used the percentages listed in Table I4-1 to obtain losses to recreational fisheries. Results are displayed in Tables I4-5 and I4-6, for impingement and entrainment, respectively, and are expressed as average annual I&E and corresponding values. The estimated total loss to recreational fisheries ranges from $44,800 to $149,100 for impingement per year, and from $62,800 to $209,100 annually for entrainment.

Table I4-5: Baseline Mean Annual Recreational Impingement Losses at the Monroe Facility and Associated Economic Values

Species	Loss to Recreational Catch from Impingement (number of fish)	Recreational Value/Fish		Loss in Recreational Value from Impingement	
		Low	High	Low	High
Bluegill	1	$0.31	$1.00	$0	$1
Channel catfish	16	$2.64	$5.02	$43	$81
Crappie	12	$1.00	$5.02	$12	$59
Smallmouth bass	10	$1.58	$5.32	$16	$53
Smelt	58	$2.95	$10.06	$172	$588
Sunfish	36	$0.31	$1.00	$11	$36
Walleye	178	$5.02	$7.92	$896	$1,413
White bass	27,190	$1.58	$5.32	$42,961	$144,653
Yellow perch	2,237	$0.31	$1.00	$694	$2,237
Total	29,739			$44,804	$149,121

Fri Feb 15 13:45:23 MST 2002 ; TableB: recreational losses and value for selected species; Plant: monroe ; type: I Pathname: P:/Intake/Great_Lakes/GL_Science/scodes/monroe/tables.output/TableB.rec.losses.monroe.I.csv

Table I4-6: Baseline Mean Annual Recreational Entrainment Losses at the Monroe Facility and Associated Economic Values

Species	Loss to Recreational Catch from Entrainment (number of fish)	Recreational Value/Fish ($2000)		Annual Loss in Recreational Value from Entrainment ($2000)	
		Low	High	Low	High
Burbot	66	$2.95	$10.06	$194	$662
Channel catfish	387	$2.64	$5.02	$1,023	$1,945
Crappie	347	$1.00	$5.02	$347	$1,740
Smallmouth bass	3,399	$1.58	$5.32	$5,370	$18,082
Smelt	1,019	$2.95	$10.06	$3,006	$10,251
Sunfish	1,821	$0.31	$1.00	$564	$1,821
Walleye	132	$5.02	$7.92	$662	$1,045
White bass	31,703	$1.58	$5.32	$50,091	$168,660
Whitefish	25	$1.50	$2.38	$37	$59
Yellow perch	4,805	$0.31	$1.00	$1,490	$4,805
Total	43,704			$62,784	$209,070

Fri Feb 15 13:45:28 MST 2002 ; TableB: recreational losses and value for selected species; Plant: monroe ; type: E Pathname: P:/Intake/Great_Lakes/GL_Science/scodes/monroe/tables.output/TableB.rec.losses.monroe.E.csv

I4-3 Value of Baseline Commercial Fishery Losses at the Monroe Facility

I4-3.1 Baseline Losses in Commercial Yield at Monroe and Value of Losses

I&E losses to commercial catch (pounds) are presented in Tables I4-2 (for impingement) and I4-3 (for entrainment) based on the commercial and recreational splits listed in Table I4-1. Values for commercial fishing are relatively straightforward because commercially caught fish are a commodity with a market price. EPA estimates of the economic value of these losses are displayed in Tables I4-7 and I4-8. Market values per pound are listed as well as the total market losses experienced by the commercial fishery. The estimates of market loss to the commercial fisheries are $229,900 for impingement per year, and $113,400 annually for entrainment.

Table I4-7: Baseline Mean Annual Commercial Impingement Losses at the Monroe Facility and Associated Economic Values

Species	Loss to Commercial Catch from Impingement (lb of fish)	Commercial Value ($/lb of fish)	Annual Loss in Commercial Value from Impingement ($2000)
Bullhead spp.	22	$0.33	$7
Burbot	0	$0.35	$0
Carp	1,880	$0.16	$301
Channel catfish	13	$0.76	$10
Freshwater drum	7,871	$0.21	$1,653
Gizzard shad	1,354,816	$0.15	$203,222
Smelt	22	$0.35	$8
Suckers	62	$0.17	$10
White bass	25,235	$0.98	$24,730
Whitefish	0	$0.82	$0
Total	1,389,920		$229,942

Fri Feb 15 13:45:23 MST 2002 ; TableC: commercial losses and value for selected species; Plant: monroe ; type: I Pathname: P:/Intake/Great_Lakes/GL_Science/scodes/monroe/tables.output/TableC.comm.losses.monroe.I.csv

Table I4-8: Baseline Mean Annual Commercial Entrainment Losses at the Monroe Facility and Associated Economic Values

Species	Loss to Commercial Catch from Entrainment (lb of fish)	Commercial Value ($/lb of fish)	Annual Loss in Commercial Value from Entrainment ($2000)
Burbot	103	$0.35	$36
Carp	190,659	$0.16	$30,505
Channel catfish	322	$0.76	$245
Freshwater drum	7,626	$0.21	$1,601
Gizzard shad	345,264	$0.15	$51,790
Smelt	383	$0.35	$134
Suckers	1,108	$0.17	$188
White bass	29,423	$0.98	$28,834
Whitefish	36	$0.82	$30
Total	574,923		$113,363

Fri Feb 15 13:45:29 MST 2002 ; TableC: commercial losses and value for selected species; Plant: monroe ; type: E Pathname: P:/Intake/Great_Lakes/GL_Science/scodes/monroe/tables.output/TableC.comm.losses.monroe.E.csv

Tables I4-7 and I4-8 express commercial impacts based on changes from dockside market landings only. However, to determine the total economic impact from changes to the commercial fishery, EPA also determined the losses experienced by producers wholesalers, retailers, and consumers.

The total social benefits (economic surplus) are greater than the increase in dockside landings, because the increased landings by commercial fishermen contribute to economic surplus in each of a multi-tiered set of markets for commercial fish. The total economic surplus impact thus is valued by examining the multi-tiered markets through which the landed fish are sold, according to the methods and data detailed in Chapter A9.

The first step of the analysis involves a fishery-based assessment of I&E-related changes in commercial landings (pounds of commercial species as sold dockside by commercial harvesters). The results of this dockside landings value step are described above. The next steps then entail tracking the anticipated additional economic surplus generated as the landed fish pass from

dockside transactions to other wholesalers, retailers and, ultimately, consumers. The resulting total economic surplus measures include producer surplus to the watermen who harvest the fish, as well as the rents and consumer surplus that accrue to buyers and sellers in the sequence of market transactions that apply in the commercial fishery context.

To estimate producer surplus from the landings values, EPA relied on empirical results from various researchers that can be used to infer producer surplus for watermen based on gross revenues (landings times wholesale price). The economic literature (Huppert, 1990; Rettig and McCarl, 1985) suggests that producer surplus values for commercial fishing ranges from 50 to 90 percent of the market value. In assessments of Great Lakes fisheries, an estimate of approximately 40% has been derived as the relationship between gross revenues and the surplus of commercial fishermen (Cleland and Bishop, 1984, Bishop, personal communication, 2002). For the purposes of this study, EPA believes producer surplus to watermen is probably in the range of 40% to 70% of dockside landings values.

Producer surplus is one portion of the total economic surplus impacted by increased commercial stocks — the total benefits are comprised of the economic surplus to producers, wholesalers, processors, retailers, and consumers. Primary empirical research deriving "multi-market" welfare measures for commercial fisheries have estimated that surplus accruing to commercial anglers amount to approximately 22% of the total surplus accruing to watermen, retailers and consumers combined (Norton et al., 1983; Holt and Bishop, 2002). Thus, total economic surplus across the relevant commercial fisheries multi-tiered markets can be estimated as approximately 4.5 times greater than producer surplus alone (given that producer surplus is roughly 22% of the total surplus generated). This relationship is applied in the case studies to estimate total surplus from the projected changes in commercial landings.

Applying this method, EPA estimates that baseline economic loss to commercial fisheries ranges from $418,000 to $732,000 per year for impingement, and from $206,000 to $361,000 per year for entrainment at the Monroe facility.

I4-4 Value of Forage Fish Losses at the Monroe Facility

Many species affected by I&E are not commercially or recreationally fished. For the purposes of this study, EPA refers to these species as forage fish. Forage fish are species that are prey for other species, and are important components of aquatic food webs. Table I4-9 summarizes impingement losses of forage species at Monroe and Table I4-10 summarizes entrainment losses. The following sections discuss the economic valuation of these losses using two alternative valuation methods.

Table I4-9: Summary of Mean Annual Impingement of Forage Fish at Monroe

Species	Impingement Count (#)	Age 1 Equivalents (#)	Production Foregone (lb)
Alewife	125	156	2
Logperch	117,327	156,793	781
Shiner spp	180,252	213,319	2,621
Forage species total	297,704	370,267	3,405

Table I4-10: Summary of Mean Annual Entrainment of Forage Fish at Monroe

Species	Entrainment Count (#)	Age 1 Equivalents (#)	Production Foregone (lb)
Alewife	0	0	0
Logperch	2,983,000	115,373	8,873
Shiner spp.	30,420,000	276,928	83,324
Forage species total	33,403,000	392,301	92,197

Replacement cost of fish

The replacement value of fish can be used in several instances. First, if a fish kill of a fishing species is mitigated by stocking of hatchery fish, then losses to the commercial and recreational fisheries would be reduced, but fish replacement costs would still be incurred and should be accounted for. Second, if the fish are not caught in the commercial or recreational fishery, but are important as forage or bait, the replacement value can be used as a lower bound estimate of their value (it is a lower bound because it would not consider how reduction in their stock may affect other species' stocks). Third, where there are not enough data to value losses to the recreational and commercial fisheries, replacement cost can be used as a proxy for lost fishery values. Typically the consumer or producer surplus is greater than fish replacement costs, and replacement costs typically omit problems associated with restocking programs (e.g., limiting genetic diversity).

The cost of replacing forage fish lost to I&E has two main components. The first component is the cost of raising the replacement fish. Table I4-11 displays the replacement costs of two of the forage fish species known to be impinged or entrained at Monroe. The costs are average costs to fish hatcheries (in dollars per pound) across North America to produce different species of fish for stocking. The second component of replacement cost is the transportation cost, which includes costs associated with vehicles, personnel, fuel, water, chemicals, containers, and nets. The AFS (1993) estimates these costs at approximately $1.13 per mile, but does not indicate how many fish (or how many pounds of fish) are transported for this price. Lacking relevant data, EPA does not include the transportation costs in this valuation approach.

Table I4-11 presents the computed values of the annual average forage replacement costs. The value of the losses of forage species using the replacement cost method is $7,000 per year for impingement and $8,000 per year for entrainment.

Table I4-11: Replacement Cost of Various Forage Fish Species at the Monroe Facility[a]

Species	Hatchery Costs ($/lb)	Annual Cost of Replacing Forage Losses ($2000)	
		Impingement	Entrainment
Alewife	$0.52	$1	$0
Logperch	$1.05	$2,104	$1,548
Shiner spp.	$0.91	$5,053	$6,559
Total		$7,158	$8,108

[a] Values are from AFS (1993).
Fri Feb 15 13:45:24 MST 2002 ; TableD: loss in selected forage species; Plant: monroe ; type: I Pathname: P:/Intake/Great_Lakes/GL_Science/scodes/monroe/tables.output/TableD.forage.eco.ter.repl.monroe.I.csv

Production foregone value of forage fish

This approach considers the foregone biomass production of commercial and recreational fishery species fish resulting from I&E losses of forage species based on estimates of trophic transfer efficiency as discussed in Chapter A5 of Part A of this document. The economic valuation of forage losses is based on the dollar value of the foregone fishery yield resulting from the loss of forage.

Table I4-12 displays the results of this method of valuing forage species lost from entrainment. Impingement results were insignificant (as estimated by this method) and thus are not discussed. The values listed are obtained by converting the forage species into species that may be commercially or recreationally valued. The values of entrainment losses range from $822,000 to $1.6 million per year.

Table I4-12: Mean Annual Economic Value of Production Foregone of Selected Fishery Species Resulting from Entrainment of Forage Species at Monroe

Species	Annual Loss in Production Foregone Value from Entrainment of Forage Species ($2000)	
	Low	High
Burbot	$148,564	$444,405
Carp	$13	$23
Channel catfish	$30	$55
Crappie	$2	$12
Freshwater drum	$4	$7
Gizzard shad	$13	$23
Smallmouth bass	$98	$331
Smelt	$83	$273
Suckers	$0	$1
Sunfish	$47	$151
Walleye	$3	$5
White bass	$12	$30
Whitefish	$673,405	$1,133,734
Yellow perch	$1	$2
Total	$822,275	$1,579,051

Fri Feb 15 13:45:29 MST 2002 ; TableD: loss in selected forage species; Plant: monroe ; type: E Pathname: P:/Intake/Great_Lakes/GL_Science/scodes/monroe/tables.output/TableD.forage.eco.ter.repl.monroe.E.csv

I4-5 Nonuse Values for Baseline Losses at the Monroe Facility

Recreational consumer surplus and commercial impacts are only part of the total losses that the public realizes from I&E impacts on fisheries. Nonuse or passive use impacts arise when individuals value environmental changes apart from any past, present, or anticipated future use of the resource in question. Such passive use values have been categorized in several ways in the economic literature, typically embracing the concepts of existence (stewardship) and bequest (intergenerational equity) motives. Using a "rule of thumb" that nonuse impacts are at least equivalent to 50 percent of the recreational use impact (see Chapter A9 of Part A of this document for further discussion), EPA estimated nonuse values for baseline losses at Monroe to range from $22,000 to $75,000 per year for impingement and from $31,000 to $105,000 per year for entrainment.

I4-6 Summary of Mean Annual Values of Baseline Economic Losses at the Monroe Facility

Table I4-13 summarizes the estimated annual baseline losses from I&E at the Monroe facility. Total impacts range from $492,400 to $962,500 per year for impingement and from $308,400 to $2,253,400 per year for entrainment.

Table I4-13: Summary of Valuation of Baseline Mean Annual I&E at Monroe Facility ($2000)

		Impingement	Entrainment	Total
Commercial: Total Surplus (Direct Use, Market)	Low	$418,076	$206,115	$624,191
	High	$731,632	$360,702	$1,092,334
Recreational (Direct Use, Nonmarket)	Low	$44,804	$62,784	$107,588
	High	$149,121	$209,070	$358,191
Nonuse (Passive Use, Nonmarket)	Low	$22,402	$31,392	$53,794
	High	$74,560	$104,535	$179,095
Forage (Indirect Use, Nonmarket)				
Production Foregone	Low	NA	$822,275	$822,275
	High	NA	$1,579,051	$1,579,051
Replacement		$7,158	$8,108	$15,266
Total (Com + Rec + Nonuse + Forage)[a]	Low	$492,440	$308,399	$800,839
	High	$962,471	$2,253,358	$3,215,829

NA = Results were not significant and thus are not reported.

[a] In calculating the total low values for entrainment, the lower of the two forage valuation methods (production foregone and replacement) was used and to calculate the total high values, the higher of the two forage valuation methods was used. For impingement, only the replacement value results are used.

Fri Feb 15 13:45:31 MST 2002 ; TableE.summary; Plant: monroe ; Pathname: P:/Intake/Great_Lakes/GL_Science/scodes/monroe/tables.output/TableE.summary.monroe.csv